DOCUMENT RESUME

ED 323 965 IR 014 609

AUTHOR Knirk, Frederick G.; Christinaz, Daniel
TITLE Instructional Technology Adoption in the Best Adult Training Organizations.
PUB DATE Apr 90
NOTE 23p.; Paper presented at the Annual Meeting of the American Educational Research Association (Boston, MA, April 16-20, 1990).
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Adoption (Ideas); *Adult Learning; Computer Assisted Instruction; Distance Education; *Educational Technology; Educational Television; Industrial Training; *Instructional Development; Interactive Video; Interviews; Military Training; Needs Assessment; Postsecondary Education; Simulation; Surveys; *Training Methods

ABSTRACT

Both interview and direct observation data were collected via on-site visits with the training directors at 22 U.S. training centers which had been identified as the best training facilities in order to examine why the instructional methods, techniques, and media changes in use had been tried and adopted, and to identify the trends these methods represent. The organizations studied included computer manufacturers, universities, military contractors, military academies, an airline, and a simulator developer. It was found that most of the organizations perform a needs assessment analysis to aid in choosing instructional methods and media, and that there is a trend toward individualized instruction and real environment simulations. While the organizations were researching computer-assisted instruction, interactive video, instructional television, and distance learning as alternatives to current training programs, only instructional television was in widespread use. Many successful programs were under the direct supervision of a high level administrator and funded at the corporate or division level; more innovation and creative activity seemed to occur if this was the case. Almost all class instruction was evaluated in some manner; however, materials and overall program evaluation was not consistently performed. Specialized according to instructional objectives, clients, and security, physical facilities included multimedia classrooms, most of which included equipment to project overhead transparencies and display videotapes and/or live television presentations. (13 references) (DB)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
☒ This document has been reproduced as received from the person or organization originating it.
☐ Minor changes have been made to improve reproduction quality.
• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

ED323965

INSTRUCTIONAL TECHNOLOGY ADOPTION IN THE BEST ADULT TRAINING ORGANIZATIONS

by

Frederick G. Knirk

and

Daniel Christinaz

AERA Conference
Boston, MA
April 16-20, 1990

IR014609

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Frederick G.Knirk
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Instructional Technology Adoption in the Best Adult Training Organizations

Frederick G. Knirk
University of So. California
801 W.P.H.
Los Angeles, CA 90089-0031

Frederick G. Knirk
University of Southern California

Daniel Christinaz
Navy Personnel Research & Development Center

Introduction

What are the best training organizations in the United States currently doing to maintain their excellence? To determine the applicability of state-of-the-art instructional technology and teaching strategies to Navy classroom training, the Navy Personnel and Research and Development Center supported a study to evaluate these training programs. On site visits with the training directors at identified training centers were arranged so that both interview and direct observation data could be collected.

This study examined why the instructional methods, techniques and media changes were tried and adopted. The trends these methods represent are of special interest. The identities of many organizations are not identified here to honor the conditions under which the visits were arranged. Many organizations were not concerned with the proprietary nature of the information given in their interviews and those organizations and individuals are identified where needed to illustrate specific points or generalizations.

Twenty-two site visits (see Table 1) and interviews with key training directors occurred beginning in the Summer of 1987. The programs, all located in the United States, were identified as the

IR014609

best training facilities, by a panel of experts. The twenty-two organizations in the study included a wide-range of organizations: two

- -

Insert **Table 1** About Here
Training Characteristics by Organization

- -

major computer manufacturers, a computer systems developer with an experimental school, a CAD/CAM training organization, an aerospace training organization, three universities, a television-based college degree granting organization, two military ISD-oriented training contractors, two military academies, three military training "commands," a government staff college, a telephone-oriented training facility, an airline, an A-V manufacturing organization that does extensive internal and external training, an AI software developer, and a training simulator developer.

Trends in Training

Analysis of Training-Related Problems

Front-end analysis, in the form of a needs assessment, job analysis, and/or tasks analysis was stressed as a requirement for designing and developing instructional materials by all individuals interviewed in the study. However, the data suggested that time was infrequently taken to perform an extensive analysis. Typically instructors, and occasionally subject matter experts (SMEs), are asked to provide copies of their materials (course objectives, outlines, tests and handouts) and requested to make suggestions for improvements when redesigning or developing existing courses. Training procedures for developing entirely new courses and materials involve a more complete

Organization Type \ Characteristics		CAI/CBT User	Indiv. Inst. (S-S)	Interactive V. Disk	Programmed Texts	A.I. Software	Simulations	Computer Image Proj.	Networked Computer TV	Elec. Feedback System	Satellite/Distance Learning	Extensive TV User	Centralized TV/File Dis.	Centralized Software Proj.	I.S.D. Model
Computer	1	U	+	+2			+1		+		+		U	U	U
	2	U	U	+				+	+	U	+	U	U	U	+
CAD/CAM	1	U	U			$	U 1	U	-			U		U	U
Training Consultants	1			+		R	+							U	+
	2	+	U	R		R		+	U			U	+	U	U
Aerospace Airline	1	+		+	U		U							U	U
	2	U	+	R	U				U	-				U	U
University Developer	1	$	3	R	+			U	U			U		+	+
	2	U	3									U		U	
	3	U	3	+		R		U	U			U			
A-V/ Simulations Producers	1	+	U	U			+	U			=	U		U	U
	2					+		U		U	U	U		U	+
	3													U	U
	4					+	U								+
	5					R						U			
Industrial Trainer	1		U					+	U		U			U	
Military Academics	1	+	+	+	U			U		-		U		U	U
	2	R	+	R	U			U				U	U	U	U
Military Training	1		U							U	+	+			+
	2														U
	3	R		R	U									-	+
	4									$					

Notes:
1. Enriched Classroom Simulation.
2. 50% of Field Training.
3. Credit only given for "control hours".

U. User
R. Researching Use
- Significantly Decreasing Use.
+ Significantly Increasing Use.
☐ A blank means use unknown; may be in other corporate units.

analysis than is common otherwise. The analysis for new courses often involved gathering data from SMEs, engineers, and from formative evaluation data and, occasionally, pilot groups.

One newly developed program for middle managers is based on analysis of data from (a) a questionnaire sent to advisory group members, (b) interviews or telephone contacts with individuals in the projected positions who were asked what they felt they needed to learn in formal course-work, and (c) faculty members/courseware designers hired because of their related expertise. No apparent attempt was made to sequence courses and classes, nor make hierarchies of objectives and tasks except on an informal "logical" basis.

The best training/educational front-end analysis was found in an academic setting. After obtaining "complete" support for a major project from an client -- in the sense they understand they have a problem and that his Center was the right agency to work on the problem -- the resource center director then spent two-thirds of the total project time (typically the Fall and Spring semesters during a school year) identifying and specifying the instructional problem, determining the objectives and the media requirements. The remaining time (typically during the summer semester) he developed the educational program and associated materials. Except, perhaps, for the unusually long time spent in getting user commitment to the instructional development effort and in obtaining the user's commitment to use the resulting program/materials, the analysis portion of their instructional development model looked like many military Instructional Systems Development (ISD) models.

Design & Delivery Modes

Most industrial and military training organizations had ISD models they generally follow. Complicated presentations were more apt to follow the rigorous instructional development procedure required by the selected instructional development model.

Many of the training organizations are moving toward individualized instruction. The use of interactive video disks, and of computers frequently seems to lead these organizations away from totally grouped activities. Many of these organizations are refurbishing their facilities and eliminating some classrooms by tearing out interior walls. The resulting large open spaces permit installing study carrels or tables for computerized delivery of individualized instruction.

A few organizations are attempting to design, or create, group-oriented "enriched classrooms" (their term). These classrooms look like, and often operate like, a real work environment. These classrooms are really training simulators. These simulators are usually "partial-task" simulators that focus on specific aspects of the real environment, but do not permit a real-time simulation of the entire environment being trained. Organizations that advocate work simulators feel that transfer to the real world is enhanced if instruction is provided in an environment that resemble the real world. One site had researched "enriched classrooms" and believed student retention of information is greater in these environments. There is no published documentation available on this issue.

Computer-based simulators, as well as physically simulated work

environments, seem to be increasing in number. SIMNET (a tank training simulator), AIRNET (a combat environment) and STEAMER (a powerplant simulator) were observed. Some of those involved in these computer-based simulators believe that the future of education lies in simulating real environments both physically and by computer programming. They feel that AI-based simulations will result in easy interfacing between learners and the "instructional program" or simulation. SIMNET strengths are well documented. U.S. "tankers" who have, historically, lost mock battles to German tank crews began winning these competitions after U.S. tank crews practiced using SIMNET prototypes. The tank crews give highly visible credit to their SIMNET training.

Typical comments included: "We are attempting to leave prescriptive teaching/ learning (conventional instruction) and go toward adaptive learning systems which are simulation-based; where the learner can focus on a wide-range of 'relevant' problems." "In the future computer-based simulation, using a lot of graphics, will be developed using Artificial Intelligence layers to ease the user interface by accepting expected or approximated responses as appropriate responses -- approximations thereof. The students should be given the problem first, then the challenge (to promote student interest and retention) and then the necessary and relevant information or processes."

Computers and Other Forms of Instructional Technology

Most of the visited organizations are researching Computer Assisted Instruction but no one was actually using it for more than five

percent of their instruction. The Air Force Academy has evaluated many authoring systems and is the closest (of the visited organizations) to making a large-scale commitment to CAI. They plan to use computer-based authoring systems to generate CAI materials, to develop classroom graphics (which can be projected in the classrooms), and to permit students who miss lectures to review the computer-based presentations themselves. The Language Department said that they had selected an interactive video disk-based authoring system for use in a limited number of classes for about 50% of the student "class-contact hours." They expect to use the interactive computer assisted instruction system mostly for drill and practice exercises.

Some organizations are adopting interactive video disks, IVD, technology for internal training. One computer manufacturing company expects that 50% of their field service training (much of it is maintenance training) will be IVD-based while another computer company expects that 75% of their internal training will become individualized within five years -- they expect to use IVDs for a major portion of this individualization. They have found that instructor-SMEs located in the training centers can supervise and answer questions from students in a wide-range of courses at one time. This instruction is considered individualized but group-based since only 40% to 50% of the time is spent in IVD training and the rest of the time is spent in group-oriented labs and lecture/discussion sessions.

Instructional television is a workhorse medium of instruction in many of these better training organizations. Special TV lighting is no longer required given the current cameras which can operate at low light levels.

Dissemination of ITV courseware via electronic distance learning procedures is increasing. Many of the corporate and the military training centers (e.g., the Logistics courses from Ft. Lee, VA and some I.B.M. management courses) either own their own satellites or lease time as cost-effective ways of disseminating quality videotaped or live instructional presentations. In many cases, feedback was encouraged from the receiving classrooms by telephone, and in other cases, by video link.

In the degree granting arena of adult education there are few institutions which use instructional technology as the primary instructional medium. Most college credits are based on "contact hours" instead of content mastery. Colleges and Universities are norm rather than criterion reference oriented. With the exception of the National Technological University (NTU), which distributes eight Masters Degree program, few institutions in higher education are regularly using television for their "distance education" programs. Robert Diamond, at Syracuse University, was typical of other interviewees when he said that until there is good ITV software, there will be little call for television-based instruction.

Program Management and Development

Most of the interviewed training program managers reported to a senior Vice-President or other high level administrator in their organizations. In addition, the successful training managers had a great deal of support from their "line" administrator. Robert Diamond, for example, insisted as a prerequisite to his taking the position at Syracuse, that he have an appointment sufficiently high in

the administrative structure (Assistant Academic Vice-President) so he could interact with the academic Deans and University Directors as a peer.

Another management-related variable which was frequently, but not consistently found in this survey, was that instructional development activities were funded at the corporate or division level and not by the individual using department. Lower level budgeting seems to require a lot of paperwork and approvals which result in poor use of personnel and resources in training centers. When the funding of the centers occurred at the higher level, and the responsibility for prioritizing and supporting activities was with the training director, more innovation and creative activity seems to occur. The managers of these centrally funded centers suggested that they were expected to use their funds in a cost-effective manner; thus, (a) courses with the larger numbers of students, or (b) those which had the worst problems, or (c) those requiring less costly fixes were the projects which received the top priority. The money used for billing and associated paperwork could be better spent for additional production materials and personnel.

The development of the training materials is often done by a team. The instructional development at CADAM was done by training "instructional designers" the content so they could design the training materials. The actual teaching, however, is usually performed by SME personnel; CADAM feels the peer relationship of their instructors to the students is very powerful -- the students need the "real world" problem solving input that is possible only from experienced individuals. The SME-instructors and the ISD-designers are physically situat-

ed together in two-person offices; this permits necessary interaction and immediate feedback as the materials are developed and as the materials are discovered to have problems when they are used. In a military training organization involved in developing CAI materials, they attempt to locate computer programmers and teach them how to be instructional designers who they then team up with subject-matter experts.

Consolidation into a central "instructional services" or "A-V center," not diffusion, of services into "satellite centers" was evident. This was due to the expense of the specialized personnel (writers, instructional designers, graphics personnel) and the cost of specialized hardware (CAD/CAM and other graphics hardware especially). Despite the current literature which often talks about the development of media centers in multiple locations near the end user, this occurrence was not evident in the centers visited during the past two years. Many large corporations had but one media production center on a site to service multiple users. In corporations with competing divisions, there was occasional duplication of services on a geographic site, but this duplication was unusual. Where divisions in a corporation seemed to actively compete, a division without a specific capability almost always seemed to use "outside" vendors for its A-V services even though these services were available in the competing division. In at least two organizations that the internal competing service center's rates were much higher than those available outside the corporation.

An administrative issue which this study could not resolve

involved the actual adherence of training organizations to current copyright law. First, it was not easy to observe the compliance with copyright practice. Second, it was difficult to obtain reliable statements about copyright practices.

Evaluation / Revision

Almost all class instruction was evaluated in some manner. While the training managers stressed that instructor effectiveness information is used by them and the instructors to evaluate the success of the instruction, the instructors often indicated they did not bother to even read the evaluations. The information was used by instructional designers to revise and improve the instruction. Information provided by the instructors indicated that the classroom evaluation data was not used very often as a significant part of the instructors annual merit review for pay or promotions purposes -- despite policy statements to the contrary in many organizations. These statements were commonly made in both military and in corporate training units.

Materials and overall program evaluation, either formative or summative, was not consistently performed. Formative evaluation of materials and the overall program by target audience students, as it is being developed, is preformed (it appeared) in less than half the development projects. This surprised me, but as one manager said, "It sure is hard to evaluate your own materials as you are too ego involved." Another manager said of contracted materials: "The contractor doesn't really want to do too much evaluation because they want to complete the materials without a cost-overrun and we often don't do too much evaluation ourselves because we want to believe we got a good

value for our training dollar."

Physical Facilities

One of the newer training organizations identified the types of training facilities they required. In summary, they are:

1) auditorium (for guest lectures and ceremonies) (with rear projection capability);
2) large classrooms for up to 50 students (these had built-in TV, VCR, overhead projectors, 35 mm slide equipment);
3) seminar rooms, or "breakout areas," for up to 15 students (where much of the instruction would occur in this organization) (with built-in overhead projectors -- many breakout areas had computers or terminals for each student [for problem solving, CAI, work on simulations [if networking is available], and electronic messaging [if networked], word processing, data base management, and "developing positive student attitudes toward the course and computers");
4) individual learner areas ("offices" or carrels where students can store materials, go to work on individual problems -- without going back to their homes or dorms;
5) other identified training support areas necessary included: dormitory rooms, cafeteria, library, bookstore, TV studios, mail room student services (book issue, typewriters, student A-V labs to produce materials for student-developed presentations, photocopy facilities) and a lounge area. All facilities were accessible to the handicapped.

In addition, the instructors and program administrators had space requirements which included: offices for the faculty and staff (3 or 4 to an office) and storage areas for their instructional media and materials.

Almost all Multi-media classrooms visited during this study included equipment to project overhead transparencies and display videotapes and/or live television presentations. Classrooms for clients and executives often had built-in television projectors mounted out of the way on the ceiling or had rear-view display capability. Some of the classrooms had equipment to display computer-based video displays. A few of the classrooms had remote-control panels or telephone systems connecting them to the central distribu-

tion center so they could pause or start presentations. Nearly a half of the classrooms had the ability to load and operate a VCR located in the classroom and many had both remote and local television distribution capability. Classrooms designed for groups varied in size with seating for about twelve to about 75 depending upon the perceived need of the various organizations.

CADAM/Lockheed designed several categories of training areas:

(a) Lecture areas having built-in TV projection equipment (for motion visuals via video and for displaying computer screens to an entire audience) and overhead projectors built down into a portable desk/lectern. The students have work tables; they like the dark oak colors better than the white-topped tables because the white tables show dirt too well. The students, however, say they like the white tables; they seem to be easier on their eyes (perhaps because there was less contrast between their papers and the desk-tops) and easier to see their pencils, etc. The instructors liked the white marking boards w/ erasable color markers; next time they said they intend to construct the entire walls of the marking material -- perhaps not white, but a light shade. This is typically the first room the students will meet in as they work on introductory cognitive or theory related objectives.

(b) Classrooms for group hands-on lecture/practice area where the classroom is like the one described above, but the set-up includes the equipment the students will be training upon (CAD computer-terminals in this case) built into the instructional area. This is the second instructional areas the students normally use as they are taught the

procedure-related objectives.

(c) "Lab" areas where the equipment is set-up in a realistic-looking environment; like the ones where the equipment would normally be used. The instructor in these labs supervises about five students at a time.

(d) "Classrooms" where their training products are "sold" to potential clients. These classrooms are much like the first environment described above, but the colors are more active (bright blues, greens, reds) and they have large comfortable chairs and a relatively small amount of desk space. It seems to me CADAM has made excellent decisions about the design of the spaces -- each related to identified cognitive objectives and affective goals.

As suggested above, in classrooms designed for grouped instruction, most of the chalk-boards in the classrooms I observed have been replaced by white or colored marking boards for "dry markers." Not only do the marking boards look more modern, but their use does not result in chalk dust which can seriously damage the computer disk drives. One organization said they chose light tan colored dry boards and tan for the walls and the desk tops. The result is an environment that looks somewhat drab. I was told "We do not want the classroom to look 'hi tech'. The white paper in workbooks, and texts will thus be somewhat brighter than the background, (desk, walls, etc.) and keep the students' attention on their learning task."

In order to illustrate how the training program was helped by the new training facilities, I was taken twice to the still existing old

buildings (some of which were still in use). Newly designed facilities had these characteristics: air conditioned, increase light quantity and quality, more attractive classroom/corridor/office colors, more attention was paid to sound control (carpeting was typically included), working (and often new) laboratory equipment. The newer environments seemed to have a calming and quieting effect on the learners.

The modern facilities had extensive conduit networks allowing them to pull additional cables for electronic distribution of computer-based or television-based materials. In the IBM example mentioned in the next paragraph the floor of the entire academic wing was built on a 15.5 cm raised floor with tail circuits in the classroom to permit convenient connection to the classroom's TV cameras and display devices. A remote control box at the instructor's desk terminated conduit to the projection room to provide control of all equipment in that area (35mm & 16 mm projectors, sound amplifiers, video and audio cassette decks, equalizers, mixers, switchers, patch panels, video and audio cassette monitors, intercom). The conduit allowed video recordings to originate in all rooms and be recorded on any of the 24 VCRs located in the video control center. The conduit make it safely possible for them to use this technology.

The flexible conduit system at an IBM training facility in Thornwood, N.Y. was a major reason for this facility being identified as the outstanding instructional facility in the United States (December 1986 issue of Engineering Educator). The facility had two major design objectives: connectivity and flexibility. By "connectivity" they meant that everything is connected to everything else. The three

major networks include (a) baseband (to provide switchable quality video and audio signals), (b) broadband (to provide video [commercial & public TV] & data [including electronic bulletin board communication] to every location at the site), & (c) establishment communications link, ECL, (a token ring system to provide voice [telephone], data and video signals). They are working on an all digital network ISDN (Integrated Systems Data Network). This connectivity results in flexibility. As the technology continues to develop, the systems will be condensed into one digital system which will be easier to use and be less costly to operate and maintain. The existing systems are used to broadcast instruction to IBM training facilities via satellite to the entire world. It allows for voice feedback to the transmitter site from the student's wherever they are located.

Electronic feedback systems, built into individual student desks, have almost disappeared -- at least in the classrooms visited in this survey. One ex-user of an electronic feedback system said: "They are time consuming and difficult to program and then yield little additional useful information that is not available by direct class observation -- they simply are not useful." Another instructor, in an airline company classroom with electronic feedback devices said: "After you take class time to get the information, what do you do with it? Do you repeat the instruction until all students indicate they understand the instruction?" One executive meeting room I visited had a good use for an electronic feedback system; the switches were mounted beneath the table which allowed the participants to anonymously vote on issues.

Many of the training organization were concerned about maintaining the security of the information they were teaching. Therefore, they often designed windowless training buildings and prohibited their instructors from using "wireless transmitters." At these organizations paper shredders or other security measures were taken to protect paper notes and materials.

Summary

Instructional development practices in outstanding U.S. industrial and military organizations reveal many trends. Front-end analysis, for example, was uniformly stressed as a requirement for designing and developing instructional materials by managers, but instructional developers and instructors suggested that time is not always devoted to performing a thorough problem analysis.

With regard to instructional design, most industrial and military training organizations had ISD models they generally followed. Especially complicated presentations, or those for clients, were more likely to follow the rigorous instructional development procedure required by the development model than less complicated training programs for in-house use. Many of the training organizations are gradually moving from grouped instruction toward individualized instruction. The use of interactive video disks, and of computer-based instruction frequently leads trainers away from totally grouped activities. An increasing number of training organizations are designing group-oriented "enriched classrooms," or simulated work environments, in their classrooms. Interest in computer-based simulators is increasing.

Most of the organizations are using instructional technology extensively. CAI is being evaluated at many of the organizations but few are using it for more than perhaps five percent of their total instruction. Many organizations said CAI is costly to develop, but that the reduced instructional time required by most CAI programs, and the ability to distribute it easily over a number of locations, made it a potentially powerful medium. ICAI, CAI materials developing using "artificial intelligence" algorithms, was not being implemented by any of these organizations. Many of the visited organizations are adopting interactive video disk technology and almost all of them are considering it for near future instruction. Instructional television is used by almost all organizations. Dissemination of courseware via satellite or microwave facilities is a common practice.

Many, but not all, of the successful program managers reported to a senior Vice-President or other high level administrator. These successful training managers had a great deal of support from their "line" administrator. Another characteristic of a successful instructional development organization is that they were funded at the corporate or division level -- and not by individual using departments. The development of training materials is usually performed by a team located in a central production facility.

There were also some evident trends involving the evaluation and revision of training materials and programs. Almost all instruction is evaluated. It appears, however, that instructors are seldom held accountable for their classroom instruction; pay increases and promotions are seldom related to classroom evaluations. Materials and

program evaluation (formative and summative), however, are not measured as consistently as classroom activities.

Training facilities were usually specialized and used for specific types of instructional objectives and clients (internal training or customer-support). More facilities are being designed for individualized and computer-based instruction. Most organizations had multimedia classrooms which were used extensively to supplement, or replace, some group-oriented lectures. Light-colored marking boards have replaced chalk boards in most instructional facilities; the chalk dust is hard on computer components and on general classroom maintenance. The modern facilities had extensive conduit networks which allows them to install additional fiber or conventional cables for electronic distribution of computer-based or television-based materials. Electronic feedback systems have almost disappeared from corporate classrooms. Facilities are increasingly being built with security in mind. Thus, windowless classrooms are increasingly common and there is concern about how to keep audio or electronic emanations from being picked up outside the training facilities.

Many trends in the best adult training organizations in the United States became evident in this study. Some instructional technologies are becoming reliable and highly used instructional tools.

Bibliography

Bowsher, J.E. (1989). Speaking with... Jack E. Bowsher, Director of Education, IBM. Instruction Delivery Systems, 3(3), 10-14.

Carlisle, K.E. (1986). Analyzing Jobs and Tasks. Englewood Cliffs, NJ: Educational Technology Publications.

Castaldi, B. (1987). Educational Facilities: Planning, Moderniza-

tion, and Management. Boston: Allyn and Bacon.

Diamond, R.M. (1989). Designing and Improving Courses and Curricula in Higher Education. San Francisco, CA: Jossey-Bass, Inc.

Ellis, J.A. (ed.) (1986). Military Contributions to Instructional Technology. New York: Praeger Publishers.

Head, G. E. (1985). Training Cost Analysis. Washington, D.C.: Marlin Press.

Higgins, N., & Reiser, R.A. (1985). Selecting Media for Instruction: An Exploratory Study. Journal of Instructional Development, 8(2), 6-10.

May, L.S., Moore, C.A., & Zammit, S.J. (Eds.). (1987). Evaluating Business and Industry Training. Boston: Kluwer Academic Publishers.

Montague, W.E., Ellis, J.A. (1983). Instructional quality inventory. Performance and Instruction, 22(5), 11-14.

Office of Technology Assessment, Congress of the United States. (1988). Power On!: New Tools for Teaching and Learning. Washington, DC: U.S. Government Printing Office.

Rossett, A. (1987). Training Needs Assessment. Englewood Cliffs, NJ: Educational Technology Publications.

Sinofsky, E.R. (1988). A Copyright Primer for Educational and Industrial Média Producers. Friday Harbor, WA: Copyright Information Services. (POB 1460; 98250; 206/378-5128)

Taylor, B.E., Ellis, J.A., & Baldwin, R.L. (1988). The Current Status of Navy Classroom Training: A Review of 100 Navy Courses with Recommendations for the Future. NPRDC TR 88-XX. San Diego, CA: Navy Personnel Research and Development Center.